

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A shape measurement system for measuring a three-dimensional shape of an object, comprising:

~~a picture taking part taking a picture of the object at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position;~~

a projecting part applying light having a predetermined pattern onto the object;

~~a picture taking position specifying part detecting a position at which said picture taking part takes the picture of the object, and generating position information specifying the position;~~

a rotation component detecting part detecting, based on a gravity direction and an angle around the gravity detected by a sensor, a rotation component of the position information specifying a position to take a picture of the object by the picture taking part;

a three-dimensional coordinate calculating part calculating a three-dimensional coordinate of each point of the object based on the ~~position information~~ rotation component and an image taken at the position ~~specified by the position information~~; and

~~a three-dimensional shape composing part expressing, by a coordinate in a single coordinate system, a three-dimensional coordinate of each point of the object calculated by said three-dimensional coordinate calculating part for the at least the first and second different positions, and to produce a composed image~~ a three-dimensional shape composing part calculating a translation component of the position information, based on at least two of the three-dimensional coordinates for each point of the object calculated by said three-dimensional coordinate calculating part, based on each image obtained from taking a picture of the object, to which the light is applied from at least two different positions, and the

rotation component, and expressing said each point, based on the translation component, by a coordinate in a single coordinate system, and to produce a composed image.

Claim 2 (Original): The shape measurement system as claimed in claim 1, further comprising:

a picture taking control part controlling operation timing of said picture taking part;
a signal converting part converting an analog signal obtained by said picture taking part into a digital signal; and
a storing part storing the digital signal, three-dimensional coordinate and composite image.

Claim 3 (Original): The shape measurement system as claimed in claim 2, further comprising an interpolation part performing interpolation processing on at least one of the image obtained by said picture taking part and the composite image obtained by said three-dimensional shape composing part.

Claim 4 (Original): The shape measurement system as claimed in claim 1, further comprising a three-dimensional image generating part generating a three-dimensional image of the object in accordance with coordinates of the object obtained by said three-dimensional coordinate calculating part and an image obtained when the light having the predetermined pattern is not applied to the object by said picture taking part.

Claim 5 (Currently Amended): A shape measurement system for measuring a three-dimensional shape of an object, comprising:

a plurality of picture taking parts with different optical centers taking pictures of the object ~~at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position;~~

a projecting part applying light having a predetermined pattern onto the object;

~~a picture taking position specifying part detecting positions at which said plurality of picture taking parts take the picture of the object, and generating position information specifying the respective positions;~~

a rotation component detecting part detecting, based on a gravity direction and an angle around the gravity detected by a sensor, a rotation component of the position information specifying a position to take a picture of the object by the picture taking part;

a three-dimensional coordinate calculating part calculating a three-dimensional coordinate of each point of the object for each image based on a plurality of images obtained as a result of pictures of the object being taken by said plurality of picture taking parts, and the position information rotation component ~~generated by said picture taking position specifying part;~~ and

~~a three dimensional shape composing part expressing, by a coordinate in a single coordinate system, a three dimensional coordinate of each point of the object calculated by said three dimensional coordinate calculating part for the at least first and second different positions, and to produce a composed image~~ a three-dimensional shape composing part calculating a translation component of the position information, based on at least two of the three-dimensional coordinates for each point of the object calculated by said three-dimensional coordinate calculating part, based on each image obtained from taking a picture of the object, to which the light is applied from at least two different positions, and the

rotation component, and expressing said each point, based on the translation component, by a coordinate in a single coordinate system, and to produce a composed image.

Claim 6 (Original): The shape measurement system as claimed in claim 5, further comprising:

a plurality of picture taking control parts controlling operation timing of said plurality of picture taking parts, respectively;

a plurality of signal converting parts converting analog signals obtained by said plurality of picture taking parts into digital signals, respectively; and

a storing part storing the digital signals obtained by said plurality of signal converting parts, three-dimensional coordinate calculated by said three-dimensional coordinate calculating part and composite image generated by said three-dimensional shape composing part.

Claim 7 (Currently Amended): A shape measurement system for measuring a three-dimensional shape of an object, comprising a picture taking device taking a picture of an object ~~at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position,~~ and a computer:

wherein:

said picture taking device comprises:

a projecting part applying light having a predetermined pattern onto the object; and

~~a picture taking position specifying part detecting a position at which said picture taking part takes the picture of the object, and generating position information specifying the position; and~~

a rotation component detecting part detecting, based on a gravity direction and an angle around the gravity detected by a sensor, a rotation component of the position information specifying a position to take a picture of the object by the picture taking part; and

said computer comprises:

a three-dimensional coordinate calculating part calculating a three-dimensional coordinate of each point of the object based on the ~~position information~~ rotation component of the position information provided by the picture taking device and an image ~~obtained as a result of the picture being taken at the position specified by the position information; and~~

~~a three-dimensional shape composing part expressing, by a coordinate in a single coordinate system, a three-dimensional coordinate of each point of the object calculated by said three-dimensional coordinate calculating part for the at least first and second different positions, and to produce a composed image~~ a three-dimensional shape composing part calculating a translation component of the position information, based on at least two of the three-dimensional coordinates for each point of the object calculated by said three-dimensional coordinate calculating part, based on each image obtained from taking a picture of the object, to which the light is applied from at least two different positions, and the rotation component, and expressing said each point, based on the translation component, by a coordinate in a single coordinate system, and to produce a composed image.

Claim 8 (Original): The shape measurement system as claimed in claim 7, wherein said computer further comprising an interpolation part performing interpolation processing on the plurality of three-dimensional coordinates calculated by said three-dimensional coordinate calculating part.

Claim 9 (Currently Amended): The shape measurement system as claimed in claim 7, wherein at least one of said projecting part and ~~picture taking position specifying~~ rotation component detecting part is controlled by said computer.

Claim 10 (Currently Amended): A picture taking device comprising a picture taking part taking a picture of an object ~~at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position,~~ and further comprising:

a projecting part applying light having a predetermined pattern onto the object;

~~a picture taking position specifying part detecting a position at which said picture taking part takes the picture of the object, and generating position information specifying the position;~~

a rotation component detecting part detecting, based on a gravity direction and an angle around the gravity detected by a sensor, a rotation component of the position information specifying a position to take a picture of the object by the picture taking part;

a storing part storing an image obtained as a result of the picture of the object on which the light ~~having the predetermined pattern~~ is applied being taken by said picture taking part, and the position information; and

~~a three-dimensional coordinate calculating part calculating a three-dimensional coordinate of each point of the object based on the rotation component and an image taken at the position specified by the position information; and~~

~~a three-dimensional shape composing part expressing, by a coordinate in a single coordinate system, a three-dimensional coordinate of each point of the object calculated by said three-dimensional coordinate calculating part for the at least first and second different positions, and to produce a composed image.~~

Claim 11 (Currently Amended): The picture taking device as claimed in claim 10, wherein at least one of said projecting part and said ~~picture taking position specifying~~ rotation component detecting part is controlled by a control signal provided externally.

Claim 12 (Original): The picture taking device as claimed in claim 10, wherein said picture taking part also takes a picture of the object onto which the light having the predetermined pattern is not applied.

Claim 13 (Currently Amended): A shape measurement method of measuring a three-dimensional shape of an object, comprising the steps of:

a) applying light having a predetermined pattern onto the object to take a picture of the object at ~~at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position;~~

~~b) detecting a position at which said step a) takes the picture of the object, and generating position information specifying the position;~~

b) detecting, based on a gravity direction and an angle around the gravity detected by a sensor, a rotation component of the position information specifying a position to take a picture of the object;

c) calculating a three-dimensional coordinate of each point of the object based on the ~~position information~~ rotation component of the position information and an image obtained as a result of the picture being taken at the position ~~specified in said step b); and~~

~~d) expressing by a coordinate in a single coordinate system a three dimensional coordinate of each point of the object calculated in said step c) for the at least first and second different positions in said step a), and producing a composed image~~ calculating a translation

component of the position information, based on at least two of the three-dimensional coordinates for each point of the object calculated, based on each image obtained from taking a picture of the object, to which the light is applied from at least two different positions, and the rotation component, and expressing said each point, based on the translation component, by a coordinate in a single coordinate system, and to produce a composed image.

Claim 14 (Previously Presented): The method as claimed in claim 13, further comprising the step of:

e) generating a three-dimensional image of the object in accordance with coordinates of the object in the coordinate system, and an image of the object obtained in said step a) when the light having the predetermined is not applied thereonto.

Claim 15 (Currently Amended): A shape measurement method of measuring a three-dimensional shape of an object, comprising the steps of:

- a) applying light having a predetermined pattern onto the object;
- b) taking pictures of the object through a plurality of picture taking parts having different optical centers ~~at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position;~~
- ~~e) detecting positions at which said plurality of picture taking parts take the pictures of the object, and generating position information specifying the positions, respectively;~~
- c) detecting, based on a gravity direction and an angle around the gravity detected by a sensor, a rotation component of the position information specifying a position to take a picture of the object;
- d) calculating a three-dimensional coordinate of each point of the object for each image based on a plurality of images obtained as a result of pictures of the object on which

the light of the ~~predetermined is applied~~ being taken by said plurality of picture taking parts, and the ~~position information~~ rotation component generated in said step ~~[(c)]~~ e); and

e) ~~expressing by a coordinate in a single coordinate system for each point of the object a three-dimensional coordinate calculated in said step d) for the at least first and second different positions, and producing a composed image~~ calculating a translation component of the position information, based on at least two of the three-dimensional coordinates for each point of the object calculated, based on each image obtained from taking a picture of the object, to which the light is applied from at least two different positions, and the rotation component, and expressing said each point, based on the translation component, by a coordinate in a single coordinate system, and to produce a composed image.

Claim 16 (Currently Amended): A computer readable recording medium ~~in which~~ storing a program for measuring a three-dimensional shape of an object through a computer, said program causing the computer to:

calculate a three-dimensional coordinate of each point of the object based on an image obtained as a result of a picture of the object taken ~~at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position,~~ on which light having a predetermined pattern is applied being taken, ~~and position information specifying a position at which the picture of the object is thus taken, and a rotation component of the position information specifying a position to take a picture of the object;~~ and

~~express by a coordinate in a single coordinate system a three-dimensional coordinate for each point of the object calculated for the at least first and second different positions, and to produce a composed image~~ calculating a translation component of the position information, based on at least two of the three-dimensional coordinates for each point of the

object calculated, based on each image obtained from taking a picture of the object, to which the light is applied from at least two different positions, and the rotation component, and expressing said each point, based on the translation component.

Claim 17 (Previously Presented): The computer readable recording medium as claimed in claim 16, wherein said program causes

an acceleration sensor to generate the position information specifying the position with respect to the gravitation; and

a magnetic sensor to generate the position information specifying the position with respect to the terrestrial magnetism.

Claim 18 (Original): The computer readable recording medium as claimed in claim 16, wherein said program causes an angular velocity sensor to detect a rotational angular velocity around each coordinate axis of the three-dimensional coordinate system.

Claim 19 (Original): The computer readable recording medium as claimed in claim 16, wherein said program further causes the computer to generate a three-dimensional image of the object in accordance with the coordinates of the object in the single coordinate system, and an image of the object obtained through taking picture of the object on which the light having the predetermined is not applied.

Claim 20 (Currently Amended): A computer readable recording medium storing a program for measuring a three-dimensional shape of an object through a computer, said program causing the computer to:

calculate a three-dimensional coordinate of each point of the object for each image based on a plurality of images ~~obtained as a result of pictures of the object taken at at least first and second positions, the second position taking a picture of at least a portion of the object not taken at the first position,~~ on which the light of the predetermined is applied being taken by a plurality of picture taking parts, ~~and position information specifying positions at which the pictures of the object are taken by the plurality of picture taking parts, and rotation components of the plurality of position information specifying the respective positions of the plurality of picture taking parts taking a picture of the object;~~ and

~~express by a coordinate in a single coordinate system a three-dimensional coordinate for each point of the object, for the at least first and second different positions, and to produce a composed image~~ calculating a translation component of the position information, based on the plurality of three-dimensional coordinates for each point of the object calculated and the rotation component, and expressing said each point, based on the translation component.

Claim 21 (Previously Presented): The shape measurement system as claimed in claim 1, wherein the three-dimensional shape composing part calculates a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 22 (Previously Presented): The shape measurement system as claimed in claim 1, wherein the three-dimensional shape composing part finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.

Claim 23 (Previously Presented): The shape measurement system as claimed in claim 5, wherein the three-dimensional shape composing part calculates a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 24 (Previously Presented): The shape measurement system as claimed in claim 5, wherein the three-dimensional shape composing part finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.

Claim 25 (Previously Presented): The shape measurement system as claimed in claim 7, wherein the three-dimensional shape composing part calculates a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 26 (Previously Presented): The shape measurement system as claimed in claim 7, wherein the three-dimensional shape composing part finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.

Claim 27 (Previously Presented): The method as claimed in claim 13, wherein the expressing d) calculates a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 28 (Previously Presented): The method as claimed in claim 13, wherein the expressing d) finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.

Claim 29 (Previously Presented): The method as claimed in claim 15, wherein the expressing d) calculates a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 30 (Previously Presented): The method as claimed in claim 15, wherein the expressing d) finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.

Claim 31 (Previously Presented): The computer readable recording medium as claimed in claim 16, wherein the program causing the computer to express further calculates a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 32 (Previously Presented): The computer readable recording medium as claimed in claim 16, wherein the program causing the computer to express further finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.

Claim 33 (Previously Presented): The computer readable recording medium as claimed in claim 20, wherein the program causing the computer to express further calculates

a rotation component applied for producing the composed image based on respective attitude angles from which the images are taken from the different positions.

Claim 34 (Previously Presented): The computer readable recording medium as claimed in claim 20, wherein the program causing the computer to express further finds corresponding points among the images taken from the different positions, and calculates a translation component applied for producing the composed image.